15 lbs). We measured relative bioavailability by area under the curve (AUC, hrxμg/ml), peak concentration (Cmax, μg/ml), time to peak concentration (Tmax, hr), renal clearance (Clr, ml/min), & weight (wt, lbs), where *p < 0.05 v. Pre:

Drug	Time	AUC	Cmax	Tmax	Clr	Wt
Fur	Pre	14.4 ± 12.5	3.1 ± 1.5	2.05 ± 0.94	44 ± 24	220 ± 28
Fur	Post	18.7 ± 21	3.9 ± 2.0	2.09 ± 1.67	45 ± 24	200 ± 28*
Tor	Pre	44.8 ± 20.36	10.9 ± 50.1	1.40 ± 0.82	6.4 ± 3.9	212 ± 46
Tor	Post	48.3 ± 22.2	13.9 ± 6.7*	0.81 ± 0.36*	6.4 ± 3.5	190 ± 44*

Wt decreased 21 lbs (range 15 to 53). In contrast to the expected outcome, intense diuresis had minimal effect on absorption and no effect on renal clearance. With diuresis, AUC increased by >30% in only 2/33 pts and Cmax increased by >30% in only 10/34 pts. There were no differences between Fur and Tor in the effects of edema on pharmacokinetics.

We conclude that bowel edema secondary to fluid overload does not alter the pharmacokinetics of Fur or Tor in most CHF pts. Therefore, oral loop diuretics may be effective in decompensated CHF pts and their use in adequate doses may save money and reduce hospitalizations.

784 Three-Dimensional Echocardiography in Valvular Heart Disease

Wednesday, March 19, 1997, 10:30 a.m.–Noon
Anaheim Convention Center, Room B2

10:30

784-1 Three Dimensional Flow Reconstruction of Irregular Stenotic Mitral Bioprostheses: *In Vitro* and Animal Studies

R. Shandas, M. Jones, M. Chikada, J. Kwon, O. Knudson, L. Valdes-Cruz. *The Children's Hospital, Denver, CO, LAMS-NHLBI, Bethesda, MD, USA*

Calculation of effective orifice areas for flow through irregularly shaped, moderately stenosed mitral bioprostheses has been problematic using current Doppler or catheter methods since the complexity of the orifice obviates many of the assumptions used in these techniques. Three-dimensional (3D) flow reconstruction of two-dimensional (2D) color Doppler images should provide complete transvalvular flow information and thereby allow estimation of irregular orifice areas. 3D flow reconstruction was performed on color Doppler images of forward flow through 4 moderately stenosed (1.65–2.88 cm^2) bioprostheses placed in a pulsatile *in vitro* system (40–80 cc/beat; 60 bpm). Additionally, 3D flow images were also obtained from 2 sheep with bioprosthetic mitral valves. Effective flow areas were obtained as the minimum cross-sectional flow area of the 3D flow image immediately distal to the orifice. Anatomic valve areas were measured by video planimetry post explantation. Irregular and asymmetric orifices due to incomplete opening of the stenotic leaflets were visualized well on the 3D flow images. 3D effective orifice areas for both *in vitro* and animal studies correlated well to anatomic areas but with overestimation ($y = 1.98x - 0.56$; $R = 0.928$; SEE = 0.28 cm^2) This overestimation is presumably due to the poor lateral resolution of the color Doppler system which cannot distinguish between jet core flow and adjacent entrainment flow. Such errors become compounded in 3D reconstructions due to the integration of all 2D flow information. 3D provides advantages over 2D color Doppler in displaying the irregular and asymmetric orifice shapes of moderately stenosed mitral bioprostheses. 3D also offers more accurate localization of the effective orifice (*vena contracta*) area than 2D or color Doppler and so should be useful in the clinical assessment of bioprosthetic valves.

10:45

784-2 Varying Morphology of Mitral Valve Commissures, Commissural Fusion and Orifice in Mitral Stenosis, Mitral Regurgitation and Combined Lesions in Rheumatic Valve Disease: A Three-Dimensional Echocardiographic Study

R. Kasliwal, A. Kanojia, S. Mittal, N. Masani, T.-L. Hsu, N. Trehan, N. Pandian. *Escorts Heart Institute and Research Center, New Delhi, India, Tufts – New England Medical Center, Boston, MA, USA*

The extent of commissural fusion (CF) is a determinant of therapeutic options but may be difficult to assess using conventional imaging techniques. The purpose of this study was to determine whether three-dimensional echocardiography (3DE) could be used to visualize the mitral commissures and orifice to assess CF in various forms of rheumatic mitral valve disease (RMVD). 3DE was performed in 54 pts with RMVD undergoing TEE. In 45 pts (83%) it was possible to create *en face* 3D images of the mitral valve viewed from above, allowing visualization of the left atrial aspect of the mitral leaflets, line of coaptation and orifice. CF was assessed in 2 ways: shape of the orifice at the commissures (either round or angulated) and appearance of the line of coaptation, whereby 0 = no visible coaptation line (dense CF), 1 = "gutter" visible (moderate CF), 2 = coaptation line clearly visible (mild/no CF). The eccentricity of the orifice was also assessed and the distance between orifice and annulus measured. The 3DE data was compared with the clinical presentation of each pt. The number of commissures classified in each group is shown in the table:

	Pts (n)	Orifice		Coaptation line			
		round	angular	0	1	2	mean score
MS	30	24	36	37	21	2	0.41
MS/MR	9	8	10	12	4	2	0.44
MR	6	0	12	1	1	10	1.75

With MS the orifice was central in 20 pts and eccentric in 10, whereas the orifice was central in 8/9 pts with MS/MR and 6/6 pts with MR. Thus, MS was characterized by more rounded orifices and dense fusion while in MR angular orifices with minimal CF were seen. 3DE provides new insights into dynamic pathology and pathophysiology of the mitral valve in RMVD that have therapeutic implications.

11:00

784-3 The Feasibility and Incremental Value of Three-Dimensional Intraoperative TEE in Valve surgery: A Prospective Study in 40 Consecutive Patients

S. Ge, J.G. Warner, Jr., T.P. Abraham, N.D. Kon, A.M. Nomeir, K. Fowle, R.F. Brooker, D.W. Kitzman. *Bowman Gray School of Medicine of Wake Forest University, Winston-Salem, NC, USA*

Three-dimensional echocardiography (3DE) has the potential to provide superior quality morphologic information compared with two-dimensional echocardiography (2DE) and this may have particular utility in cardiac valve surgery. In order to assess the feasibility and incremental value of intraoperative 3D TEE, a prospective trial of intraoperative 2D and 3D TEE was performed in 40 consecutive patients undergoing mitral and aortic valve surgery using a multiplane TEE probe and a TomTec EchoScan 3D workstation. We documented 3D acquisition and reconstruction times and compared echocardiographic morphologic valve findings with surgical and direct pathologic examination by an independent blinded observer.

Results: Mean 3D TEE acquisition time was 3.0 ± 1.7 min/acquisition, and reconstruction time (time required to process and reconstruct clinically acceptable 3DE images) was 10.7 ± 5.0 min. Adequate 3DE images were obtained in 36 (90%) of the patients and in 85% were able to be viewed by the surgeon before sternotomy. In 10 patients (25%), 3D TEE provided additional information that was not appreciated by 2D transthoracic and TEE and that was confirmed by surgery and pathology, including: 5 leaflet perforations and 1 tear; 1 remnant and 1 broken subaortic ridge; 2 central inadequate AV coaptations and 1 inadequate coaptation of the medial scallop of the PML; and 1 organized thrombus. *Conclusion:* In the operating room setting, 3D TEE acquisitions and reconstructions can be successfully completed in nearly all patients in a relatively short amount of time and can yield new findings not appreciated by 2D transthoracic and TEE examinations.

11:15

784-4 Quantification of Mitral Valve Prolapse by Three Dimensional Echocardiography: Correlation with Biomechanical Characteristics of Excised Valve Tissue

C.S. Breburda, I. Vesely, A.R. Brewer, N.B. Ratliff, D.M. Cosgrove, III, J.D. Thomas, B.P. Griffin. *The Cleveland Clinic Foundation, Cleveland, OH, USA*

The relationship of the biomechanical alterations (BA) to in vivo anatomical abnormalities is not well understood in myxomatous mitral valve disease (MVP). *Method:* We studied 10 pts who underwent mitral valve repair (mean age 63 yrs, range 57–75) with intraoperative transesophageal three dimensional (3D) echo (TomTec) using a multiplane probe. 3D prolapse volume (PV) and prolapse area (PA) were quantitated in 1 mm slices and compared to uniform geometry, stiffness (a function of elasticity), failure tension and load tensile measurements (which reflect extensibility) of the excised mitral tissue. *Results:* 9 pts had a flail posterior mitral leaflet, 1 pt had severe prolapse. All pts had 4 + mitral regurgitation and normal ejection fraction (mean